Hydroclimate reconstruction of Western Iberia over the last 3600 years - insights from lipid biomarker and specific isotope signal

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Located between the temperate and arid climates of Europe and North Africa, Iberia is one of the most climatic vulnerable regions of Europe with more severe and longstanding extreme climate events being expected in this region. The Iberian climate, mainly in winter, is modulated by the North Atlantic Oscillation (NAO). Persistent positive (negative) NAO phases, can lead to significant changes in the North Atlantic westerly wind-belts, resulting in strengthened (weakened) winter precipitation in Western Iberia.

The Iberian Central System mountain range constitutes one of the biggest physical barriers to the moist air masses coming from the Atlantic Ocean. Usually, under low anthropic influence, the high mountain lake ecosystems have sensitive responses to climate and environmental changes, which makes lake sediments a pristine record for paleo reconstructions.

The increasing number of studies on Iberian high lakes depicted a wide spectrum of spatiotemporal variability in climate and environmental conditions for the last few millennia. However, the paucity of archives from the western region hampers the understanding of the effect of major climate forcings on different climate periods.

In this sense, to assess the past hydroclimatic patterns over western Iberia, we study upper 120 cm sediments of a 5 m core retrieved from a high mountain lake in central Portugal (Lake Peixão, Serra da Estrela). The age and depth model provides a robust chronology of the last 3600 years based on four $^{14}$C AMS dating on pollen concentrates and $^{137}$Cs and $^{210}$Pb profiles.

Here we present the preliminary results on sedimentary lipid biomarker (leaf wax n-alkane) and compound-specific hydrogen isotope ($\delta D_{\text{wax}}$) analysis performed at centennial time scale resolution. n-Alkane characterization, based on diverse indices (e.g., ACL, CPI, Paq, relative percentages, etc.), shows a clear higher plant signal, with a strong odd-over-even carbon predominance of long-chain n-alkanes, and predominance of the C$_{31}$ homologue. Principal component analysis (PCA) applied to the odd n-alkanes (C$_{17}$ – C$_{35}$) concentrations reduced the data dimensionality into two principal components (PC). The PC1 mostly represents total n-alkane
concentrations. PC2 has a positive correlation with Paq, C$_{27}$, and δD signals, while a high negative correlation with ACL. Another important feature of the PC2 signal is its parallelism with NAO index reconstructions.

Our new data show a sensitive response from the lake catchment vegetation to hydroclimatic variability and allow the reconstruction of climatic phases occurring in this region based on plant waxes from Lake Peixão.

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